

WHAT IS CLAIMED IS:

CLAIMS

1. An efficient amplifier comprising:

means for amplifying an input signal via a high-speed switch and providing an amplified signal in response thereto and

5 means for filtering said amplified signal via common mode rejection and providing an output signal in response thereto.

2. The amplifier of Claim 1 wherein said means for filtering includes first means for separating an input signal into plural intermediate signals, and wherein said means for amplifying includes second means for amplifying said plural intermediate signals via one or more high-speed switches and providing plural amplified signals in 5 response thereto, and wherein said means for filtering further includes third means for employing common mode rejection to filter said plural amplified signals, yielding a single output signal in response thereto.

3. The amplifier of Claim 2 wherein said first means includes a broadband input balun that receives said input signal and provides a first intermediate signal and a second intermediate signal as output in response thereto, said broadband input balun sufficient to impart approximately 180 degrees of relative signal phase rotation 5 between said first intermediate signal and said second intermediate signal so that said intermediate signals are approximately 180 degrees out of phase.

4. The amplifier of Claim 3 wherein said second means includes a first high-speed transistor and a second high-speed transistor coupled to said first intermediate signal and said second intermediate signal, respectively, and outputting a first

intermediate amplified signal and a second intermediate amplified signal,
5 respectively.

5. The amplifier of Claim 4 wherein said first high-speed transistor and said second high-speed transistor include one or more Metal Semiconductor Field Effect Transistors (MESFET's) and/or one or more Pseudomorphic High Electron Mobility Transistors (pHEMPT's).

6. The amplifier of Claim 4 wherein said third means includes a broadband output balun, said output balun oriented to combine said first and second intermediate amplified signals into one output signal lacking common mode components common to said first intermediate signal and said second intermediate signal.

7. The amplifier of Claim 6 wherein said broadband output balun and/or said broadband input balun include slotline T-junctions.

8. The amplifier of Claim 7 wherein said broadband input balun is a slotline balun that includes single coplanar waveguide followed by a transition to a slotline waveguide having a slotline T-junction that separates said slotline waveguide into two slotline legs, each slotline leg transitioning to two corresponding coplanar
5 waveguides.

9. The amplifier of Claim 6 further including an output network with one or more tunable capacitors.

10. The amplifier of Claim 9 further including a controller in communication with said one or more tunable capacitors, said controller running an algorithm to optimize amplifier bandwidth.

11. The amplifier of Claim 10 wherein said one or more tunable capacitors include one or more Barium Strontium Titanate (BST) tunable capacitors.

12. An efficient amplifier comprising:
first means for separating an input signal into plural intermediate signals; and
second means for amplifying said plural intermediate signals via one or more high-speed switches and providing plural amplified signals in response thereto and
5 third means for employing common mode rejection to filter said plural amplified signals.

13. An efficient switching-mode amplifier comprising:
a broadband balun that provides two or more channels from a single input channel and
a switch connected in series to each of said two or more channels.

14. The amplifier of Claim 13 wherein said broadband balun is a broadband input balun, and wherein said amplifier further includes an output circuit connected at an output of said switch, said output circuit having a broadband output balun that provides a single output channel from said two or more channels.

15. The amplifier of Claim 14 wherein said broadband input balun is a slotline balun that includes an input coplanar waveguide followed by a transition to a slotline waveguide having a slotline T-junction that separates said slotline into two slotline legs, each slotline leg transitioning to corresponding output coplanar 5 waveguides.

16. The amplifier of Claim 14 wherein said switch includes one or more high-speed transistors.

17. The amplifier of Claim 16 wherein said one or more high-speed transistors include one or more Metal Semiconductor Field Effect Transistors (MESFET's).
18. The amplifier of Claim 16 wherein said one or more high-speed transistors include a Pseudomorphic High Electron Mobility Transistor (pHEMPT).
19. The amplifier of Claim 18 wherein said amplifier is an S-band Coplanar Waveguide (CPW) push-pull class-E amplifier.
20. The amplifier of Claim 19 wherein said pHEMPT is approximately 0.3 μm by 1000 μm.
21. The amplifier of Claim 18 wherein said amplifier is an X-band monolithic push-pull class-E amplifier.
22. The amplifier of Claim 21 wherein said pHEMPT is approximately 0.3 μm by 600 μm.
23. The amplifier of Claim 18 wherein said amplifier includes one or more tunable circuit components to increase bandwidth of said amplifier.
24. The amplifier of Claim 23 wherein said one or more tunable circuit components include a tunable capacitor.
25. The amplifier of Claim 24 wherein said tunable capacitor is a Barium Strontium Titanate (BST) tunable capacitor sufficient to tune a load or output matching network of said amplifier for operation over a broad bandwidth between 1 to 20 GHz.

26. The amplifier of Claim 14 wherein said switching-mode amplifier is a class-E amplifier, and wherein said broadband input balun is a low-loss broadband slotline balun.

27. The amplifier of Claim 26 wherein said amplifier is integrated with a GaAs Monolithic Microwave Integrated Circuit (MMIC).

28. An efficient switching-mode amplifier comprising:

an input circuit having a broadband slotline input balun, said broadband input balun providing two channels from a single input channel and imparting approximately 180 degrees of relative phase rotation between said two channels;

5 a switch connected in series to each of said two channels, said switch characterized by little or no overlap between voltage and current waveforms and incorporating one or more Pseudomorphic High Electron Mobility Transistors (pHEMPT's), said switch outputting amplified signals on said two channels; and

10 an output circuit having a broadband output slotline balun, said broadband output slotline balun providing a single output channel from said two channels, said single output channel lacking common mode components existing in said amplified signals, said output circuit further including a Barium Strontium Titanate (BST) tunable capacitor.

29. An efficient method for amplifying an input signal comprising:

separating an input signal into plural intermediate signals;

amplifying said plural intermediate signals via one or more high-speed low-loss switches and providing plural amplified signals in response thereto; and

5 employing common mode rejection to filter said plural amplified signals.